The Owner's Level of Effort

in Design-Build Contracts

by

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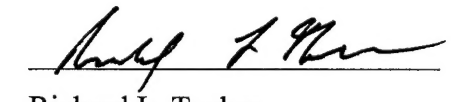

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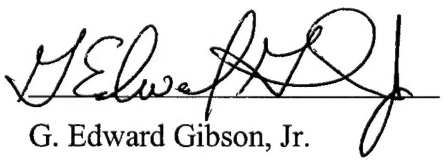

G. Edward Gibson, Jr.

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CHAPTER 1

INTRODUCTION

Project delivery systems currently used in the United States can broadly be divided into three principal categories: design-bid-build, construction management at risk, and design-build. Over the past decade as owners, in both the private and public sectors, have pushed for faster delivery and lower costs for their projects, design-build has been increasingly heralded as the optimum solution for most situations. Recent research has supported such claims showing design-build outperforming the other systems in terms of cost and schedule, while equaling or exceeding the other systems in quality performance.

While many owners have experimented with design-build and are now expanding its use for their organizations, there are other owners who have not tried design-build and do not know how to begin. In order for owners to make the best choices for their projects, a complete understanding of the differences between design-build and traditional design-bid-build methods is required as well as knowledge of the different options available within the design-build system. This thesis is an initial step towards defining those differences. The remainder of this chapter summarizes the motivation, objectives, and methodology used for this research.

1.1 Motivation

The Naval Facilities Engineering Command has been using design-build techniques on its projects since authorized by Congress in 1985. However, the use of this project delivery method has ranged across the full spectrum from requests for proposals of less than twenty pages to those with volumes of detailed specifications and design drawings. Projects at both extremes have been used to deliver highly successful projects. In the past three years, the Navy has increased its emphasis on using design-build elevating it to its first choice for use on most projects. The positive results achieved and the breadth of experience with design-build makes the Navy a proper model for educating other owner organizations on the differences between design-bid-build and design-build delivery systems.

1.2 Objective

The objective of this study is to highlight the differences, from the owner's point of view, between design-build and traditional design-bid-build project delivery methods. While the focus of this thesis is related to projects within the Department of the Navy, most of the information is applicable to other public agencies as well as private owners. It should serve as an educational tool for owners beginning to explore design-build for their projects. It can also be useful for educating clients unfamiliar with design-build processes.

1.3 Methodology

The first phase of research and literature review focused on familiarizing the author with other research and articles pertaining to the use of design-build for project delivery. Additionally, the statutory regulations and historic use of the design-bid-build and design-build systems within the Navy were studied in depth to provide a full understanding of the two processes. The process descriptions were then reviewed and validated by NAVFAC civilian employees. Their feedback was considered and implemented as necessary into the appropriate final discussions. Finally a survey was conducted of NAVFAC military and civilian personnel to determine what perceptions are held regarding changes in their level of work when shifting from design-bid-build work to the newer design-build process.

1.4 Thesis Organization

The remainder of the thesis is organized as follows. Chapter 2 provides background information on the Navy as an owner in the construction industry including its organization and the political environment in which it must work. Additionally, current literature and applicable research will be discussed to provide the context for this thesis. Chapter 3 will then document the life cycle of a project using the Navy's traditional design-bid-build project delivery system. This chapter is based on current Federal, Department of Defense, and Navy regulations

and guidance. The Design-build process currently in use by the Navy is then compared to design-bid-build in Chapter 4. Results from a survey of military and civilian personnel in the Naval Facilities Engineering Command are presented. Chapter 5 then summarizes the two methods presented with final conclusions and recommendations.

CHAPTER 2

LITERATURE REVIEW

This chapter provides background information on Military Construction and the Navy's role as an owner. It also defines the principal project delivery systems currently being used in the United States. Finally, pertinent research completed in the U.S. and abroad that relates to the subject matter will be reviewed. This summary will serve as the context in which this thesis and future studies might fit.

2.1 Military Construction

Within the Navy, construction projects with costs exceeding $300,000 are required to go through a deliberate planning and programming process to prioritize the needs of various operational commands. This process normally starts very early with project description and estimates being forwarded through the chain of command for inclusion on the Six-Year Defense Program. Design will often begin prior to the planned budget year for the project in order to provide more detailed scope and estimate data to Congress as part of the President's budget proposal. This early design process allows an activity to have designs "on the shelf" ensuring the award for the construction contract can be made as soon as possible after funds are authorized for the project.

The Defense Authorization Act and annual Military Construction (MILCON) Appropriation by Congress provide the authority and the funds for individual projects each year (U.S. Dept. of the Navy, 1996). For fiscal year 2001, the President has proposed over $700 million dollars for Navy and Marine Corps MILCON projects. When combined with other programs such as Family Housing construction and funds for Base Realignment and Closure (BRAC), the proposed budget includes a total of $8.0 billion for the Navy and other branches of the Department of Defense (U.S. Dept. of Defense, 2000).

2.2 The Navy as an Owner

In order to support its peacetime and wartime missions, the Navy's sailors, ships, submarines, and planes are supported by a vast infrastructure of shore facilities. Most of the facilities belong to either an operational command, such as the Atlantic Fleet or to one of the major system commands, or major claimants. These major claimants, such as the Naval Air Systems Command, control the budgets within their warfighting or support mission area.

One of these major claimants, the Naval Facilities Engineering Command (NAVFAC) serves as the Navy's facility engineering organization offering services from planning and real estate acquisitions, through design and construction, maintenance and operation, to disposal or turnover of facilities for other uses. These services are also provided for the Marine Corps and to some Air

Force commands. As such, NAVFAC is responsible for managing the MILCON process and for the execution of the authorized construction projects. This function falls under the Engineer Programs Group as shown in Figure 2.1.

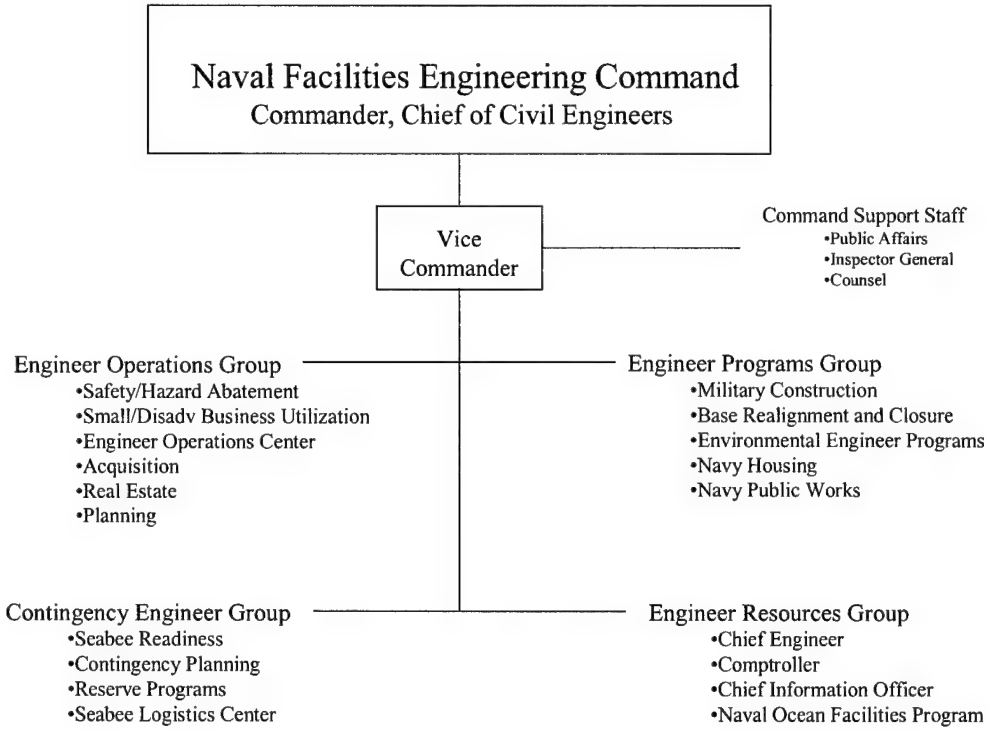

Figure 2.1 NAVFAC Headquarters Organizational Chart

In order to execute these projects, NAVFAC has many field offices located at Navy, Marine Corps, and Air Force bases. These field offices are organized by region under Engineering Field Divisions (EFDs) and smaller Engineering Field Activities (EFAs). These regions are shown in Figure 2.2.

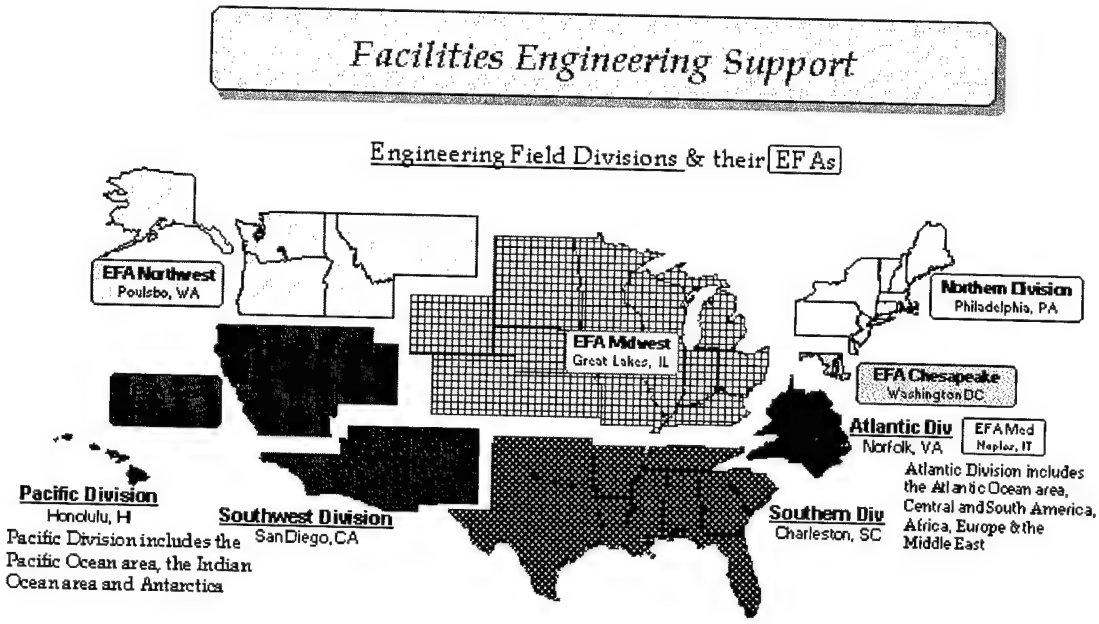

Figure 2.2 Map of NAVFAC's Engineering Field Divisions

For MILCON projects, the EFD or EFA normally manages the planning and the award of contracts with input and assistance from the local field offices. For execution, project management shifts to the local field offices under the direction of a Resident Officer in Charge of Construction (ROICC) with the EFD providing support as required. For many smaller projects, the field office will handle all aspects of project management. In the past decade, as acquisition reform has swept through the Federal Government, the Navy has increasingly turned to creative ways to deliver projects faster and cheaper for the warfighters

while raising the bar on quality as well. This emphasis has led to use of a variety of project delivery methods.

2.3 Project Delivery Systems

Project delivery systems generally fall under one of three types: design-bid-build, construction management at risk, or design-build. While there are many variations, this thesis is based upon the following definitions.

1. *Design-Bid-Build:* Under this traditional project delivery system, the owner's organization manages two separate and distinct contracts, one for the design and a second for the construction. Typically this is accomplished in sequential steps with the designer hired to produce a complete set of drawings and specifications as the first step in the execution phase. These design documents are then usually incorporated into a solicitation package inviting competing construction companies to bid for the construction work. The owner will normally select one of the bidders to perform the work detailed in the design plans and specifications, often for a firm, fixed price. These three steps, design, bid, and build, characterize this project delivery system and offer the maximum separation of the design and construction functions.

2. *Construction Management at Risk*: As with design-bid-build, in this system the owner still contracts with two separate entities. One, the designer, fulfills the same roll as before providing the owner with a complete set of design

documents for a new facility. However, the second contract under construction management at risk is for construction management services including the construction work. This arrangement offers the owner a consultant type relationship and is typically performed for a fee. This method offers the benefit of construction input during the design phase, which can lead to constructability improvements that can improve the cost, schedule, and safety performance of the project as a whole. Additionally, the construction manager can use his input and knowledge of the work to begin work earlier through phased design and construction schedules. As this thesis is concerned with the differences between design-bid-build and design-build projects, construction management at risk will not be discussed further.

3. *Design-Build:* Design-Build projects differ significantly from the other two systems in that the owner organization hires a single contractor to provide both design and construction services. The contractor may be a single entity with in-house design and construction capabilities, or a joint venture between a design and construction firm. Regardless of the business arrangements between the various contractors, this system allows the owner a single contract for design and construction of a new facility. Depending on the amount of risk involved, these contracts may range from firm, fixed price to cost plus fee contracts. There are also several variations of design-build contracts that depend on the degree of services provided for the owner by the design-builder.

2.4 Historic Perspective

The historical trends that have led to the recent shift from design-bid-build methods towards single-source design-build have their roots in ancient times. Centuries ago, owners turned to the master builder to design, engineer and build projects on grand scales (Branca, 1997). This system was the prominent method until the 20th century. Limited owner resources, increased competition and technological advances in manufacturing and construction eventually led to a highly segmented industry of specialists. The divisions between designers and constructors led to a division of work by specialty area with contracts being competitively bid by consultants and contractors. These forces led naturally to the sequential design-bid-build methods still in use today.

However, this approach, which separates the design process from the construction of the facility, limited the interaction between architects and engineers and the builders being tasked to complete projects as designed. This division led to inefficient and difficult-to-build designs and increased disputes between parties resulting in higher costs, longer schedules and increased management efforts for the owner organizations (Potter, 1995). With the economic and political environments changing at an ever-increasing pace, such delays and costs became unbearable for owners and the construction manager role

was introduced to provide necessary input during the design phase and to shorten project durations by overlapping construction with design.

Despite the gains in time and less in-house effort toward managing facility projects, the use of contract managers still did not break the barriers which had developed between builders and designers. Liability and contract disputes still often keep the two groups as competitors instead of collaborators. One solution to help minimize such risks for the owner and still maintain the benefits of time and cost savings was to use package deals, placing multiple functions in the execution phase of a project under a single contract as in design-build contracts. While the Navy has been using such methods for over a decade, as recently as 1997 design-build contracts represented only about 10% of the total. However, this figure has since more than tripled (Hedges, 2000).

2.5 Research in Project Delivery

As owners have developed new ways to build their facilities, research has followed seeking to improve the chances for project success and to help owners and contractors optimize their plans, policies and practices. The rest of this chapter will highlight some of those efforts.

Much effort has been focused on non-empirical studies about attitudes, opinions, and different perspectives on varying project delivery methods. Such research offers important insight into why certain systems are selected.

One such study, which targeted public sector projects, was conducted to test the existence of primary factors for owners selecting design-build over other project delivery methods. Molenaar (1995) surveyed 88 owner organizations at the federal, state, and local level and conducted interviews to rank fifteen project characteristics known to affect project success. Of these characteristics, five factors were determined to be most critical:

1. A well defined scope
2. A shared understanding of scope between stakeholders
3. A sophisticated owner organization
4. Sufficient owner staffing
5. An established budget.

Building on these results, Songer (1996) researched both private and public owner organizations to determine the owners' reasons for selecting design-build methods. Using the results from one hundred eight survey responses, Songer cited seven factors that owners felt were important reasons for choosing design-build. The seven factors were:

1. Shorten duration
2. Ability to establish cost early

3. Reduce cost
4. Offer constructability/innovation
5. Ability to establish project schedule
6. Reduce claims
7. Accommodate large project size

In addition to determining why owners were choosing to use design-build, Songer also sought to compare the results from the two different owner groups, private and public sector. Three of the factors were found to be identical for both groups – one, two, and seven. Furthermore, pooled variance hypothesis testing showed that all but one of the factors had no significant difference. Hence, both public and private organizations can be considered to be seeking the same results from using design-build.

Research has also turned to empirical studies to measure the success of various project delivery methods in meeting their users' expectations. Often these studies have compared different delivery methods against each other based on project success factors.

Pockock and Liu (1996) conducted a study using 209 military projects. These projects were divided between traditional (design-bid-build) methods and design-build delivery systems as well as including partnering as a delivery factor. Partnering is a non-contractual arrangement that seeks to build a team mentality

between project stakeholders as they recognize and work toward common goals. Sixteen of the projects combined partnering techniques with a design-build contract.

Contrary to popular opinions and anecdotal experiences, the projects studied showed slightly lower performance for design-build projects in terms of cost and schedule growth when compared to design-bid-build projects. Projects that used partnering techniques showed better performance in terms of schedule, but not in terms of cost. The mean values from this study are shown in Table 2.1.

Additional comparisons were made between delivery methods based on the number of contract modifications. Differences in project delivery systems had no clear impact on the outcome in terms of change orders. Instead, restrictions and conditions of individual projects should be considered in combination with delivery method factors.

Table 2.1 Summary Results of Delivery System Performance

Delivery Method	Number of Projects	% Cost Growth	% Schedule Growth
Design-bid-build	40	6.37	26.23
Design-build	90	8.48	27.76
Partnering	63	8.62	17.06
Combination	16	10.44	18.76

Roth (1995) also studied the performance of design-build contracts in the military. His research studied child care facilities built by the Navy and included six design-build and six design-bid-build of similar size and scope. This sample of projects showed less cost growth for design-build (6.51% to 11.36%) and lower cost per square foot ($167 to $188) than for design-bid-build. These results differ considerably from Pocock and Liu's work and support owner's attitudes towards the design-build method of project delivery.

Two other studies have examined the different delivery systems in greater detail, one conducted by the University of Reading Design and Build Forum and the other sponsored by the Construction Industry Institute (CII). Both of these studies utilized objective data collected from a large selection of projects. Results in both cases demonstrate positive benefits gained through the effective use of design-build over other systems.

In the Design and Build Forum's work 332 projects in the United Kingdom were analyzed, one half of which were design-build and 156 of which used traditional design-bid-build (Bennett, Pothecary and Robinson, 1996). The remaining ten used a newer fee-based management approach in which a management firm is involved early in the delivery process. The Forum limited its conclusions to design-build and design-bid-build methods due to the limited number of responses using the newer management approach.

Objective comparisons of their data showed design-build projects offered improvements in construction speed (12%), project delivery speed (30%), reductions in unit cost (13%), more certainty of finishing on time and within 5 percent of the budget, and greater chances for achieving the specified level of quality.

In addition to basic univariate comparisons, the Forum also ranked other variables that influenced construction speed, delivery speed and unit cost. Regression results showed the delivery method to have less importance on project performance than the project size, type of facility, and unit cost were more critical to the speed and cost performance indicators. The relative rankings of the eleven variables are shown in Table 2.2.

Table 2.2 Ordered Influence of Variable on Metrics

(From Bennett, et al., 1996)

	Construction Speed	**Delivery Speed**	**Unit Cost**
Number of Projects	223	176	240
Explained Variation	90%	80%	51%
Project Size	1	1	5
Building Type	2	4	1
Unit Cost	3	2	N/A
Complexity	4	6	2
Procurement	5	3	4
Technology	6	11	7
Innovation	7	5	8
Building Structure	8	10	9
Existence of Basements	9	9	10
Quality	10	8	6
Aesthetics	11	7	11
Location	N/A	N/A	3

Sanvido and Konchar (1998) looked at 351 projects in the United States that were completed between 1993 and 1998. As with the UK study, their research measured the impact of delivery methods on construction speed (measured in square feet completed per month), project delivery speed, which factored design effort into the construction speed, and on unit cost. Quality was also measured by surveying facility owners on the difficulty of turnover and the

actual versus expected performance of the facility systems. In addition to traditional methods and design-build, this study included the construction management at risk delivery system.

According to their data, "design-build (DB) unit cost was at least 4.5% less than CM-at-risk (CM@R), and 6% less than design-bid-build (DBB)" (Sanvido and Konchar, 1998). Design-build also outperformed the other delivery systems in construction speed with results 7% faster than CM@R and 12% faster than DBB. Delivery speed showed the greatest impact where gains of 23% and 33% were measured over CM@R and DBB methods.

Seven specific areas were targeted to measure the quality of a facility based on owner surveys. These were start-up, callbacks, operation and maintenance, the buildings structure and envelope, interior space and layout, environment, and equipment. Quality results placed DB projects equal with or exceeding their counterparts.

In addition to the performance measures, Sanvido and Konchar identified other critical factors that were shared by the most successful projects. Table 2.3 summarizes these factors. Table 2.4 illustrates commonalities of the worst performing jobs.

Table 2.3 Attributes of Top Performing Projects

Performance Factors	Percentage of Top Performing Jobs
Adequate to excellent ability by the owner to make decisions	95%
Adequate to excellent scope definiton	90%
Excellent team communications	87%
Qualified contractor pool	85%
High ability to restrain the contractor pool	71%

Table 2.4 Attributes of Worst Performing Projects

Performance Factors	Percentage of Worst Performing Jobs
Limited or now prior team experience	76%
Engaged contractor late in the design process	73%
Numerous difficult contract clauses	69%
Poor ability to make decisions	65%
No prequalification of bidders	62%

Building on the work of Sanvido and Konchar and other members of its research team, CII has developed a tool to assist owners in choosing a project delivery system. The Project Delivery System Selector (CII, 1999) is intended to

help users "select the system best suited for their particular facility goals" (p. 1). As with the research, the three project delivery systems considered are design-bid-build, design-build, and construction management at risk. The selection of a particular system is accomplished through a six-step process based on the owners' critical project goals and other considerations coupled with their ability to achieve success factors considered critical to a delivery methods success. The workbook also intends to educate owners about the proven performance of the three delivery systems as well as raise their awareness of those characteristics shared by highly successful projects.

Alhazmi and McCaffer (2000) have also developed a tool called the Project Procurement System Selection Model (PPSSM) that includes a wider variety of procurement methods divided into three groups shown in Table 2.5.

Table 2.5 Procurement Methods of the PPSSM

Separated & Cooperative Procurement Methods	**Integrated Procurement Methods**	**Management Oriented Procurement Methods**
Traditional Method	Design and Build	Management Contracting
Two-stage Tendering	Package Deals	Design and Manage
Negotiation Method	Turnkey	Construction Management
Serial Contracts	Develop and Construct	
Cost Reimbursable Contracts		

The PPSSM uses four screening steps to systematically select the most appropriate delivery system. First, delivery systems are ranked according to their feasibility based on the project's characteristics. Systems that are not considered feasible are then listed separately from those considered in the next step. This second list is then evaluated by decision makers based on a comparison of each system's benefits and disadvantages. Lower ranked systems are eliminated from further consideration. Next, a weighted evaluation is used to identify the optimum procurement system based on the factors considered to be most influential in the selection process. Finally, computerized decision support software identifies the best alternative solutions or course of actions based upon the analytic hierarchy process theory developed by T.L. Saaty (1994).

The systems developers then conducted a survey in Saudi Arabia to test their system for effectiveness and efficiency of use and to assist public agencies in selecting the most appropriate delivery system for their projects. Using the PPSSM, Saudi Arabian officials selected design-build to be the most appropriate procurement method for fulfilling the needs of the client and project requirements.

2.6 Summary

The research discussed supports two major conclusions:

1. Owner organizations are turning to design-build delivery systems in order to control schedule growth and costs on projects while lowering the amount of in-house resources needed for management.

2. Design-build delivery methods when matched with appropriate project characteristics are capable of speeding delivery and lowering project costs.

As owners' expectations are matched by design-build capabilities it can be expected that design-build projects will continue to expand their share of the industry work. For owner's hoping to cash in on this delivery method, an understanding of what they must do differently is required. The next two chapters of this thesis will analyze the differences in processes used by the U. S. Navy on design-bid-build and design-build projects.

CHAPTER 3

TRADITIONAL METHOD OF FACILITY ACQUISITION IN THE NAVY

In order to understand what is different in design-build contracts, it is important to first have a full understanding of the traditional methods it is now replacing. This chapter discusses the Navy's processes for a project's lifecycle from concept through the construction phase and the political, regulatory and statutory environment in which the processes work.

3.1 The Project Life Cycle

While there are many different models for a project's life cycle, each one labeling stages slightly different from the next, there are generally five steps that carry an idea from its conception through its realization to its demise. Cleland and Ireland (2000) offer the following titles for these five phases that are easily adapted to the facility arena: conceptual, development, production (construction), operational, and divestment. Each of these phases contains specific functions and the transition from one phase to the next is marked with a major milestone.

Because this thesis is concerned with the differences between design-bid-build and design-build processes, the last two phases will be ignored with the

focus being on the first three phases that Morris (1988) labels as feasibility, planning and design, and production in his construction model.

Stage I, Feasibility, is concerned with formulating the concept, considering alternatives and conducting various studies to determine the viability of the project in meeting the organizations goals. The appraisal of all information developed in this phase results in a "Go/No Go" decision.

In Planning and Design, the approved concept is further developed. Basic design parameters arise from the specific study of the facilities purpose and user requirements. Initial cost and schedule estimates are calculated and the project team decides upon an acquisition plan. It is important to recognize that the "design" portion of this stage is concerned with developing the project scope, not a detailed design. The project then transitions into Production as contracts are awarded to execute the plan.

In construction projects, the Production phase consists of both the detailed design and construction efforts. In traditional design-bid-build contracts the solicitation process is also included in this phase. Upon completion of the Production phase, the facility is considered substantially complete. Figure 3.1 illustrates Morris' model.

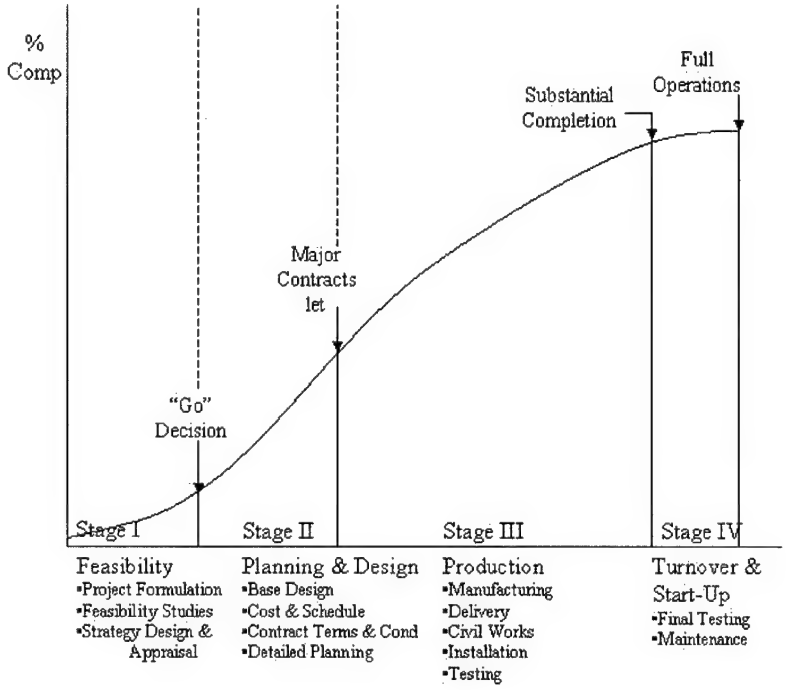

Figure 3.1 Project Life Cycle and Milestones

3.2 Pre-Project Planning

In construction, those steps that carry an idea through the necessary steps to the beginning of execution (the Production Phase) are considered part of Pre-Project Planning. In recent work, CII's Research Team 155 has developed a Project Definition Rating Index for Building Projects to assist owners navigate these steps maximizing the potential for project success (Cho, 2000). In his thesis at the University of Texas at Austin, Furman (1999) developed Logic Flow Diagrams for this process.

The PDRI is broken into three sections: Basis of Project Decision, Basis of Design and Execution Approach, each with several categories of work. The Category Diagram developed through Furman's research can be mapped against Morris' life cycle model, as shown in Figure 3.2, to provide a framework for the discussion of the Navy's processes.

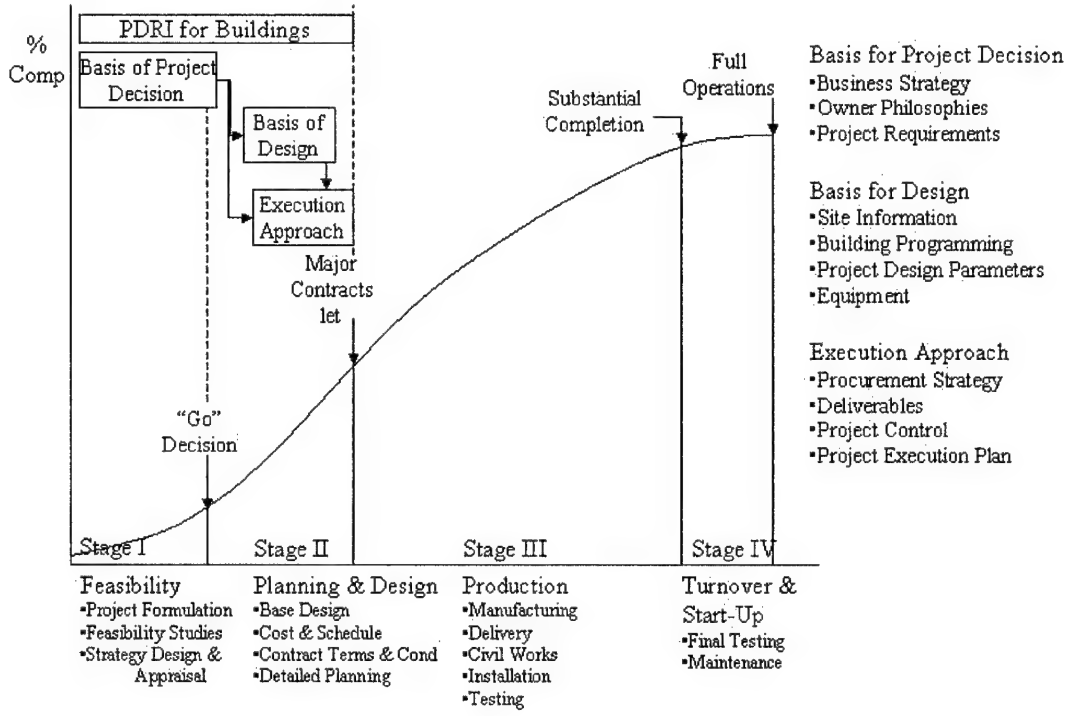

Figure 3.2 Construction Life Cycle Stages with Pre-Project Planning Details

3.3 Navy Policy Guidance and Authority

The processes NAVFAC uses to plan, design and build the Navy's facilities as well as the authority to do so are established through a hierarchical

system of laws, regulations, and instructions. These documents assign specific responsibilities to NAVFAC and proscribe the ways in which these responsibilities can and cannot be carried out. Much of the direction is based on laws intended to ensure fair competition or as part of social programs intended to benefit disadvantaged groups.

The Chief of Naval Operations (CNO) has assigned NAVFAC responsibility for carrying out the Military Construction Program for both Active Duty and Reserve components (U.S. Dept. of the Navy, 1987). Additionally, NAVFAC is to provide the other components in the Navy's command structure the necessary technical assistance in carrying out their responsibilities in the CNO Policy and Command Responsibility for Shore Activity Land and Facilities. It is with this authority that NAVFAC develops its processes for facility acquisitions. However, it must do so within the boundaries established by law and other regulations.

The highest level of direction comes from the Federal Acquisition Regulation (FAR), which is published annually and regularly updated. The FAR is part of the Code of Federal Regulations (CFR) established by law and appears at 48 CFR Chapter One. The FAR System is "established for the codification and publication of uniform policies and procedures for acquisition by all executive agencies" (GSA, 2000). The system includes not only the FAR but also any agency regulations that implement or supplement the FAR. Agencies are only

allowed to be more restrictive than the FAR; they may not ease or lessen the requirements of the FAR. The Department of Defense publishes the Defense FAR Supplement (DFARS) to provide further direction to the military services on carrying out the FAR's instructions.

According to the guiding principles contained in the FAR, this system is intended to accomplish the following:

1. Satisfy the customer in terms of cost, quality, and timeliness of the delivered product or service;
2. Minimize administrative operating costs;
3. Conduct business with integrity, fairness and openness; and
4. Fulfill public policy objectives.

In addition to general information and administrative matters, the FAR contains sections on Competition and Acquisition Planning, Contracting Methods and Contract Types, Socioeconomic Programs, General Contracting Requirements, Special Categories of Contracting, Contract Management, and Clauses and Forms. Chapter 36, under Special Categories of Contracting, contains requirements specific to Construction and Architect-Engineer Contracts. Implemental and supplemental information in the DFARS follows the same organization, but adds a two in front of chapter numbers. Hence the DFARS chapter on Construction and A-E Contracts would be 236.

Beyond the FAR and DFARS, the Secretary of the Navy publishes the Navy Acquisition Procedures Supplement (NAPS). It is intended to implement and supplement the Federal System for all Department of the Navy activities. The NAPS follows the same numbering convention adding a five before the related DFARS chapter number (236 becomes 5236). Furthermore, NAVFAC publishes the Naval Facilities Engineering Command Contracting Manual (P-68) to "provide general guidance to field contracting officers in the execution of their delegated authority" (NAVFAC, 1998).

All other publications and processes used by the NAVFAC in carrying out its Military Construction responsibilities must comply with the regulations contained within these four documents. It is within this context that the traditional design-bid-build delivery system will now be discussed.

3.4 Shore Facility Planning System

In the Navy, the planning phase of the project life cycle discussed above is embodied in the Shore Facilities Planning System (SFPS). This process, managed by NAVFAC, determines what facilities are necessary for the operational commands to achieve their assigned missions, utilizing their existing facility assets to their optimum and helping assign increasingly limited resources for new construction (U.S. Dept. of the Navy, 1990). There are five steps to the SFPS process:

1. Facility Requirements;
2. Assets Evaluation;
3. Analysis, Concepts and Proposals;
4. Implementation; and,
5. Quality Assurance.

1. *Facility Requirements:* Each naval activity, whether it is an air station, base, or other command, is responsible for its Basic Facility Requirements (BFR). These requirements are the result of a process that considers the activity's mission, workload, assigned tasks, and base loading. The intention is only to list needs and there is no prioritization based on funding concerns or current facility assets. In order to accomplish this step, the activity may use in-house personnel, such as a Public Works Department, or pay for services provided by a regional Public Works Center, Engineering Field Division, or contractors. Regardless of how the BFR is prepared or by whom, the cognizant EFD or EFA will review it for consistency with applicable guidance. The BFR is the major outcome of the Facility Requirements phase of the SFPS.

2. *Assets Evaluation:* Records on all Navy-owned and leased land and facilities are maintained in the Navy Facility Assets Data Base

(NFADB). These facilities are periodically inspected and evaluated to determine their condition. The EFD will perform an Engineering Evaluation in coordination with the activity. Major factors considered in this inspection are the facility's use and current users, size (square footage) and location, its physical condition including its suitability for other uses, and its potential for planning actions such as renovation, conversion, reassignment or demolition. While this step is separate from the development of the BFR, both steps are critical prior to beginning the third phase of the SFPS.

3. *Analysis, Concepts and Proposals:* In this phase of the process, the activity's assets are compared against its requirements to identify surplus facilities and deficiencies. This critical step allows the planners to make the best decisions for optimum use of facilities often without resorting to new construction. Whether surplus buildings are converted to another use, substandard facilities are upgraded, excess buildings are planned for demolition, or new construction is planned, this step requires that various funding sources be considered for each planned action. This information, as well as the results of the analysis of needs versus assets, is included in the Facility Requirements Plan (FRP), which is the final product of this stage.

4. *Implementation:* In the context of the SFPS, implementation is the decision to act on recommendations contained in the FRP. When a new facility will be acquired, the implementation step includes an economic analysis to determine the appropriate method and funding source for the project. Most major projects will be part of the Military Construction (MILCON) program. For these projects, implementation will include initiation of the MILCON process shown in Figure 3.3. The steps in the first column begin with the submission of a form DD 1391, which describes the requirement along with required justifications, cost estimates, and other basic information. They result in a project being included on the MILCON Requirements List (MILCON RL). During reviews in the Budget Years, the responsible EFD will certify its valid projects as "ready for design." NAVFAC updates the RL and authorizes 35 percent design.

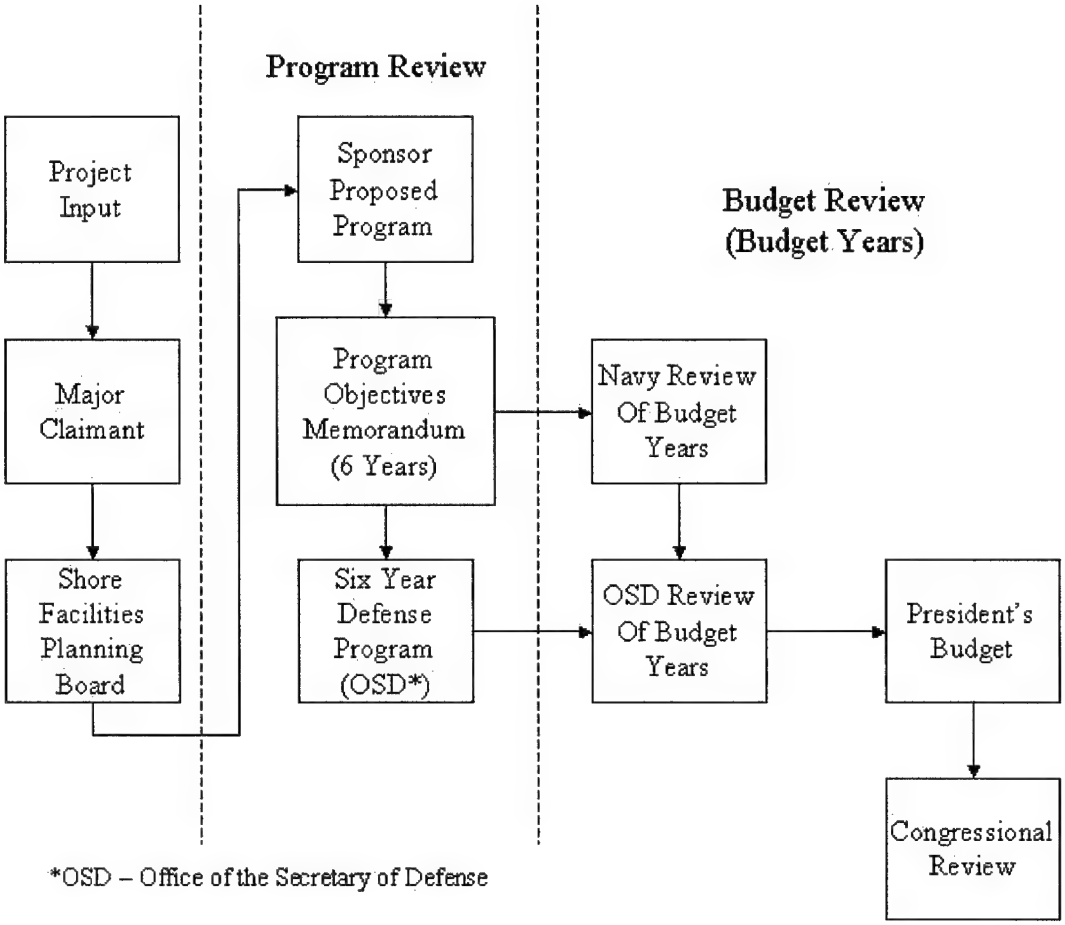

Figure 3.3 The Navy POM Process

5. *Quality Assurance:* In order to measure and ensure the effectiveness of each phase of the SFPS, feedback is taken at every step. Comparisons of various products, such as the FDP and MILCON RL, are evaluated and distributed to activities and Major Claimants to provide the status of their facilities planning and programming and to assist in future planning.

3.5 Project Execution

When using the traditional design-bid-build process, the execution phase of a project consists of three distinct stages: the design, solicitation and, finally, construction. For MILCON funded projects execution begins when authorization is given to begin design.

1. *Project Design:* On most MILCON projects, the design portion of the execution phase will be managed by the cognizant EFD or EFA. While these organizations contain their own design divisions, the vast majority of work is done through private architect-engineer (A/E) firms. The process for selecting these firms is governed by the FAR. Public Law 92-582, enacted as the Brooks Bill in 1970, provides that:

> The Government shall publicly announce all requirements for architect-engineer services and negotiate contracts for these services based on the demonstrated competence and qualifications of prospective contractors to perform the services at fair and reasonable prices (GSA, FAR 36.601-1, 2000).

The solicitation and source selection processes normally required for federal procurement are suspended for A/E services and instead firms

are evaluated solely on the basis of their qualifications and ability to perform the services required. Evaluation boards comprised of highly qualified employees with experience in architecture, engineering, construction, and Government and related acquisitions matters. The evaluation board is required to hold discussions with at least three of the most highly qualified firms to discuss concepts and possible alternative methods. A report is then prepared listing in ranked order at least three firms considered to be the most highly qualified to perform the required services.

The selection authority, the head of an agency or designated representative, reviews the recommendations of the evaluation board, gathers additional advice as necessary and makes a final selection of firms "most preferred" to perform the work. No firms may be added to the evaluation board's list, and if the most preferred contractor is different from the board's recommended most highly qualified, the selection authority must provide written justification for the ranking. All firms on the list are considered "selected."

Once the proper authority has selected the firms, the contracting officer is able to begin negotiations for the services with the most preferred firm by requesting a proposal. If a mutual agreement cannot be reached the contracting officer requests a Best and Final Offer (BAFO)

and notifies all parties of the termination of negotiations. The process then continues with the other selected firms in order of their ranking. Upon reaching an agreement a contract, normally firm-fixed-price, is signed between the A/E and the Navy.

During the detailed design phase, the EFD's design division is the lead member of the Project Management team. They will act as liaison with the activity's personnel to arrange necessary site visits, convey the user's needs to the designers, and conduct detailed design reviews at the 35 and 100 percent submissions as well as for the final design submission. In addition to these technical reviews, engineers and inspectors from the field offices conduct a constructability review on the 100 percent and final submissions, while the Major Claimant and Public Works Department or Staff Civil Engineer ensure a functional review is completed by the client no later than the 35 percent review (Westmoreland, 1991).

The design phase of a project is finished when a completed design package, including plans, specification, and other products required by the contract, is provided to the Navy and accepted. Usually, however, the Navy will contract for additional services from the firm to be performed during the construction phase. These post construction award services (PCAS) entail such functions as the review of contractor submittals and Requests for Information (RFIs), as well as site visits to inspect the work

in progress. While the EFD will continue to maintain contact and provide support throughout the project, Field Office personnel normally manage PCAS contracts.

2. *Solicitation and Award:* Once a design has been completed in the design-bid-build system, a Request for Proposals (RFP) or Invitation for Bids (IFB) is developed. This solicitation contains the design documents as well as the contractual terms and conditions required by the FAR and Navy guidelines. It can be developed at the EFD or in the Field Office depending on the project.

The construction contract is then obtained using one of two systems: sealed bidding (IFBs) or competitive proposals (RFPs). Per the FAR, sealed bidding must be used if:

1. Time permits the solicitation, submission, and evaluation of sealed bids;
2. The award will be made on the basis of price and other price-related factors;
3. It is not necessary to conduct discussions with the responding offerors about their bids; and,

4. There is a reasonable expectation of receiving more than one sealed bid.

Lack of adequate planning is not an acceptable justification for using alternatives when time is not available for sealed bidding. For this reason it is important that the Project Manager ensures pre-construction actions take place in accordance with the schedule required by the FAR. Generally for sealed bids, the following timeline applies:

1. Notice of proposed solicitation (Pre-solicitation Notice) published in the Commerce Business Daily (CBD).....Minimum 15 days
2. Issuance of solicitation.....Milestone
3. Preparation of Bids by prospective Contractors...Minimum 30 days
4. Bid Opening.....Milestone
5. Evaluation of Bid.....1 to 5 days
6. Award to the low, responsive, responsible bidder.....Milestone

One of the results of using "low bid" selection methods is a potentially high change order rate as some contractors are forced to build their margin through changes in the project scope. This is particularly prevalent when design reviews are not properly conducted or fail to catch

design conflicts and errors and omissions. To combat this result as well as the sometimes combative nature of negotiations, the Navy has turned increasingly to techniques such as partnering to foster feelings of mutual respect between the project stakeholders. Additionally the use of source selections, or competitive proposals, has enabled the selection of contractors who present the overall best value to the Government as opposed to the bottom line, lowest bid.

The most common justification for not using sealed bid procedures is to take into consideration items other than price when making an award. A contractor's past experience on the particular project type and in Department of Defense contracts can be utilized in conjunction with price and other factors to select the contractor whose proposal offers the maximum benefit to the Government. Under this method, the source selection criteria must be established in advance and published as part of the solicitation.

There are two separate and distinct evaluations that comprise the competitive proposal process. The first, the Technical Evaluation Board (TEB), is normally comprised of between two and five members with experience and expertise that are pertinent to the project at hand. The TEB evaluates the proposals on technical merit only with no consideration

given to price at this stage. They then make the following recommendations listed in NAVFAC's Contracting Manual as necessary:

(1) Rank technical proposals by a written narrative explaining any significant differences. Points, colors, or alphanumerical ratings, shall not be used.
(2) Identify strengths, weaknesses and deficiencies in the proposals.
(3) Technical discussion questions for the proposers.
(NAVFAC, P-68 Subpart 15.303, 1998).

Upon the completion of their analysis, the chairperson of the TEB presents the recommendations to the second board, the Source Selection Board (SSB). Like the TEB, the SSB is comprised of two to five members. However, a senior contracting official must be included and NAVFAC counsel will be assigned to advise the SSB. The purpose of the SSB is to evaluate the prices as compared against the technical evaluations. They will make the following recommendations to the Source Selection Authority (SSA) upon completion:

1. The need for discussions, and suggested questions if required.
2. Competitive range determinations, and
3. Selection of the winning proposal.

The SSA is a designated contracting officer who is responsible for ensuring the process is run in accordance with the governing laws and

regulations. Based on the inputs from the TEB and the SSB, the SSA will personally choose the successful proposal and award the contract accordingly.

Once a contract has been awarded by sealed bids or negotiated bids, the final step in the Production Stage, Construction, begins.

4. *Construction Management:* As soon as a contract is awarded in the design-bid-build system, the contractor will forward required submittals to the Navy for immediate action. When the EFD awards a contract, they will normally accept the contractor's bonds and subcontracting plans. Administration after this point is then transferred to the Field Office at the local activity. Normally a Civil Engineer Corps Officer or a Civilian Engineer will act as the owner's on site project manager or Field Construction Manager (FCM). When the ROICC awards the contract, the FCM immediately assumes responsibility for the review and approval process for the required submittals (Atlantic Div, 2000).

Most ROICC's have standard operating procedures for managing this initial stage of the contract before construction actually starts. Among the administrative submittals required before work can begin are the Safety and Quality Control Plans and the Schedule of Prices. A Pre-construction Conference (PRECON) provides an opportunity for key

ROICC and contractor personnel to meet and review the many administrative details and general conditions for working on the particular base. Normally this will be scheduled within two weeks of the contract award and will be chaired by the FCM. Once the PRECON has been held and the required submittals have been accepted, a Notice to Proceed is given to the contractor. This is also a time when partnering sessions are held.

Once actual work begins on site the project enters arguably the most dynamic stage in its lifecycle. With increased specialization in the industry, there will be numerous subcontractors working for the prime. This factor combined with increasingly compact project schedules can easily cause the on-site labor force to reach into the hundreds and even the thousands on very large projects. This increased number of stakeholders requires the FCM to follow sound procedures consistent with the primary objective to safely deliver a quality facility with minimal time and cost growth. Instead of continuing a sequential process for managing the project, the FCM must be proactive in anticipating the needs of the contractor. Rather than Navy policies and regulations driving the project schedule, the contractor's progress schedule becomes the driver.

Due to the nature of this phase, the remainder of this section will not attempt to place a rigid structure for performing the various functions

required in managing a construction contract. Instead, a list of the major categories of concern and their significant elements will be provided.

Safety: Due to the requirements of Law and the FAR, the Government and the contractor are both responsible for project safety. One of the submittals that must be completed prior to beginning work on site is the contractor's Safety Plan. In addition to the regulations established and enforced by the Department of Labor Occupational Safety and Health Administration, the Navy includes a requirement in its contracts that requires the contractor to follow the Army Corp of Engineers Safety and Health Requirements Manual (U.S. Dept. of the Army, 1996).

In addition to reviewing the Safety Plan for completeness and accuracy, the Field Office personnel also must ensure the plan is being followed throughout construction, conduct safety inspections around the job site, and conduct investigations should an incident occur.

Quality Assurance (QA): In support of NAVFAC's goal to provide high quality facilities in support of clients' needs, construction contractors are assigned responsibility for Quality Control (QC). As with the safety plan, the QC plan must be submitted and approved prior to beginning work. The overall QC Program includes the QC Organization, QC Plan,

QC Meetings, three phases of control (field inspections), and management of the technical submittals.

The three phases of control are used to ensure the quality of construction meets or exceeds the minimum requirements in the contract. The three phases are: the Preparatory Phase, in which all pertinent information is reviewed prior to beginning a new aspect of the work (drywall, for instance); the Initial Phase when work begins on a definable item of work and minimum standards are established for the remainder of the work to be measured against; and, lastly the Follow-up Phase, which is ongoing until the end of that particular item of work.

Quality Assurance, the Government's role in the QC Program consists primarily of monitoring the contractor's execution of his plan. It also includes the government's management of technical submittals including the Operations and Maintenance and Warranty information.

There is one additional function that can be included under the QA/QC Program - the tracking and management of Requests for Information (RFI's). These forms are an informal method of asking for and receiving additional information when a conflict or other problem arises. Often, the A/E firm is used to answer these questions under their PCAS contract.

Schedule Management: While it is the contractor's responsibility to manage the project to keep it on schedule, the FCM also must be familiar with the original schedule submission as well as with the monthly updates. Careful attention to the schedule can help identify potential problems and schedule slippage at a point early enough to correct it with minimal impact to other activities.

Invoices/Payment: The Navy pays its contractors for Work in Place (WIP) on a monthly basis. Therefore at the end of each month, the prime contractor must submit detailed records to support its request for payment.

Change Order Management: Finally, the owner must be prepared to handle change orders during the construction phase. While there are many causes for contract modifications, the most effective way to manage and control change order costs is to provide the contractor with timely decisions and answers to his questions. This will allow the planned flow of work to continue with a minimum of disruption, which should limit unnecessary extended overhead costs or claims. In order to achieve this goal, the entire organization, including the A/E firm will need to work as a team.

3.6 Summary

Every project goes through the same steps to move from an idea to a finished product. This chapter has detailed the processes the Navy uses in traditional design-bid-build contracts. From these processes, a list of basic owner functions can be shown over time through the Feasibility, Planning and Design, and Construction stages. This list is shown in Figure 3.4. In the next chapter, the processes for design-build contracts will be discussed with emphasis on how it differs in level of effort and/or timing.

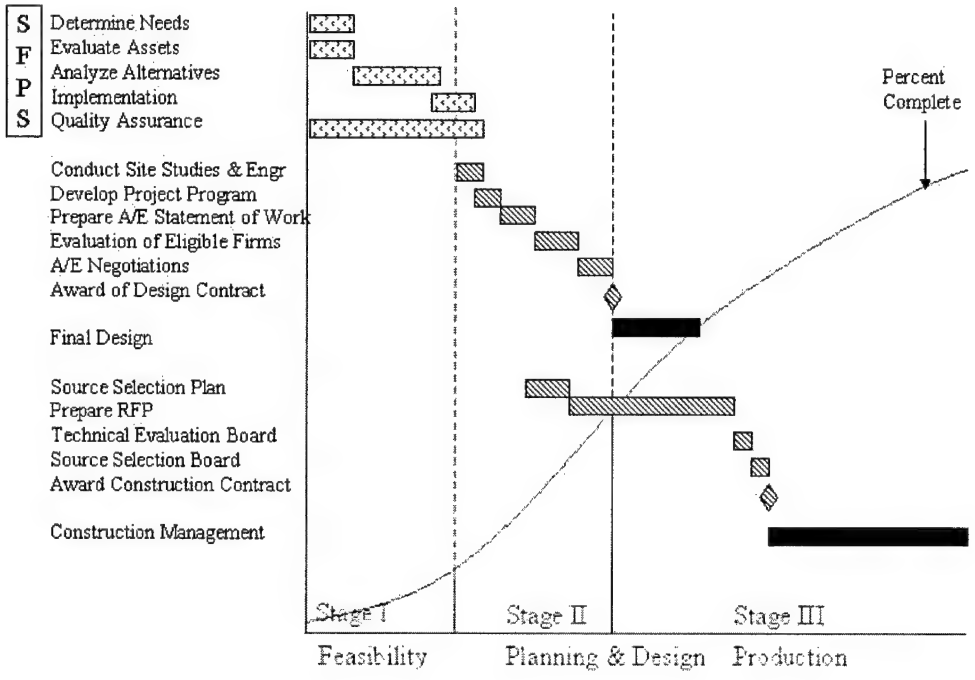

Figure 3.4 Owner's Functions by Stage (Design-Bid-Build/RFP)

CHAPTER 4

DESIGN-BUILD IN THE NAVY

Having discussed the typical process used in design-bid-build contracts, this chapter will focus on the process being used in the Navy with design-build delivery systems. The model used for this chapter is an eleven-step macro process developed by NAVFAC's Southern Division (South Div, 2000), and both the similarities and differences between the two delivery systems will be highlighted.

In addition to studying South Div's process, a survey was sent to 120 NAVFAC military and civilian employees. The results from 27 respondents will be discussed at the end of this chapter.

4.1 Feasibility and Acquisition Planning

In the last chapter it was noted that the first stage of a project is the Feasibility Stage in which a concept is formulated and analyzed along with its alternatives to reach a "Go/No Go" decision. In the Navy's structure, this phase is carried out through the Shore Facilities Planning System (SFPS) with its five step process: 1) Facility Requirements; 2) Assets Evaluation; 3) Analysis, Concepts and Proposals; 4) Implementation; and, 5) Quality Assurance.

For large construction projects requiring MILCON funding and approval from Congress, the end result of the SFPS is to have the project included on the

MILCON Requirements List (RL). The MILCON RL is then tracked and updated annually until it is 1) certified ready for design during the budget year reviews, and 2) authorized by Congress as part of the MILCON program for the coming Fiscal Year. This process is essentially the same for all MILCON projects and is independent of the delivery method to be used.

The decision process to determine a project's delivery system occurs parallel to the Program Objectives Memorandum (POM) process discussed earlier and illustrated in Figure 3.3. As a proposed project advances towards its budget years, regularly held Acquisition Planning Boards will determine what delivery method will be used for a given project. These boards, also called Acquisition Strategy Boards, are held at both the activity and EFD levels depending on the scope of various projects being discussed.

For smaller projects funded by individual activities, this decision covers a wider range of options as a variety of sources including in-house forces, pre-negotiated line item contracts and other delivery methods can be used. However, for MILCON projects the work is generally to be executed under a new contract or contracts. For MILCON projects an Acquisition Planning Board is used to determine whether the new contract(s) will be design-bid-build or design-build. Current practice in South Div is for all MILCON projects to be constructed using design-build unless peculiar circumstances for a specific project make it

unpractical. NAVFAC's other three EFDs are also moving towards a "design-build first" policy.

4.2 Planning and Design

While the traditional design-bid-build projects discussed in the previous chapter can begin the design portion of the execution phase prior to the project receiving funding from Congress, design-build projects remain in the Planning and Design stage until approved by Congress. Activities in the Planning and Design Stage consist of the first six steps of South Div's process, including three planning steps and three procurement steps.

1. *Site Studies and Engineering Services* consists of preliminary investigations of the project's planned location. The site's topography and existing utility locations are surveyed, and a determination on the existence of and impact on wetlands is completed. Geotechnical conditions are investigated as well as the potential for hazardous materials. All of the engineering studies are intended to provide a thorough and accurate site analysis before developing the project's scope.
2. *Developing the Project Program* is the process by which the EFD Design Division analyzes the user's requirements and describes the operational, functional, and space planning aspects from both an

architectural and engineering perspective. This can be accomplished through a concept design that demonstrates that a facility can be designed to meet the user's needs. Estimates can also be performed to ensure the desired functionality and level aesthetics can be reached within budget. The user's requirements should be fully documented to provide the basis for writing Section 01155, "Facility Program Requirements," of the Request for Proposals (RFPs).

3. *Developing the Source Selection Plan* is a part of the Acquisition Planning required by the FAR in Part 7.105. The Source Selection Plan includes the timing for submission and evaluation of proposals, the participants in the selection process and their responsibilities, the evaluation factors and their relationships, and the evaluation method to be used. All of the above factors should be developed towards the best value attainment of the projects objectives.
4. *Phase I - Requesting Statements of Qualifications* from prospective design-build contractors allows the Government to determine the most highly qualified firms who will be asked to submit proposals for the project. Phase One of the evaluation process will be based on a.) technical approach (not including detailed design or technical information), and b.) technical qualifications, such as the firm's experience and competence, its capability to perform and past

performance. Other factors may be considered, but in no case are cost or price related factors to be included in Phase One. The goal is to select the most highly qualified offerors to submit proposals for the second phase.

5. *Phase II – Preparing Request for Proposals (RFP)* completes the documents necessary for the selected firms to prepare their packages including cost proposals. The RFP contains the performance and prescriptive technical specifications as well as site information, general conditions and administrative procedures, the project program and contract clauses. The project requirements must be clearly communicated to the contractors while still leaving them room for design, technical, and methodology decisions to deliver the best value combination of quality and price.
6. *Solicitation, Reception and Evaluation of Phase II Proposals* should follow the requirements of the FAR and other guidelines as well as the guidance provided in the Source Selection Plan. The evaluation process is very similar to the source selection process described for design-bid-build contracts in the proceeding chapter. Two boards are utilized to review the different portions of the proposals: a technical evaluation board reviews information such as design concepts, management approach, key personnel, and proposed technical

solutions. The second board, the Price Evaluation Board determines the economic value of the competing proposals. Normally, South Div awards design-build contracts based on a lump sum, firm fixed price that includes both design and construction. This emphasizes the need for extra focus on preparing the RFP documents in the previous step in order to allow the contractors to adequately estimate their costs to complete the project. The Source Selection Board and the Source Selection Authority, who makes the final decision for contract award, use the information from the Technical and Price boards in making their decision.

This award of the design-build contract, which incorporates the successful contractor's proposal with the RFP, mark's the ending of the Planning and Design Stage and the beginning of Production. This corresponds with Morris' (1988) project life cycle model and its transitional milestones. In order to minimize project delivery timeframes, the procurement process is planned to complete as soon as possible after Congress authorizes the military budget.

4.3 Project Execution

The next three steps in SouthDiv's eleven-step design-build process are part of Morris' Production Stage. They include the overlapping steps of final

design and construction as well as the Navy's administering of the business aspects of the contract. The overlapping of design and construction provides this delivery method with its opportunity to shorten project durations. This difference between design-bid-build and design-build is highlighted in Figure 4.1. Additionally, it involves the constructor in the design, which may improve the constructability of the project.

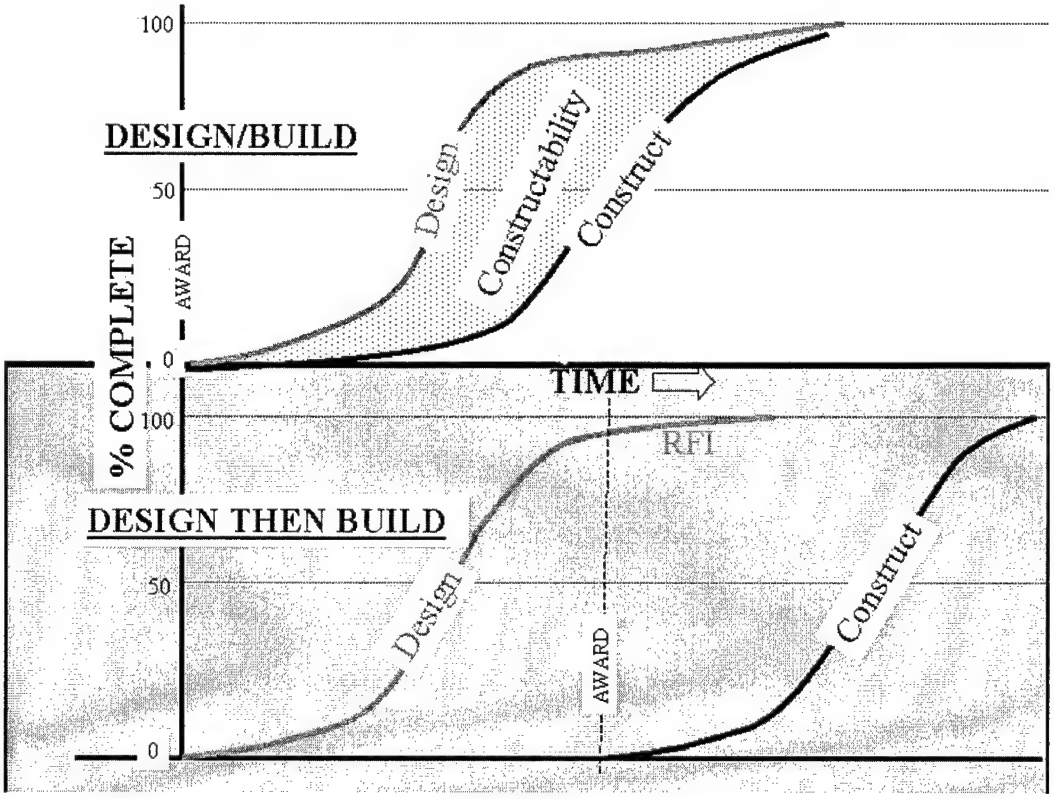

Figure 4.1 Project Execution Curves

1. *Developing the Final Design* requires the successful design-build contractor to develop and finalize the design drawings and specifications used for construction. The Navy controls this function through the review and acceptance processes. In order to maximize the potential benefits of design-build contracting, the minimum necessary documentation should be produced that will allow the project to be built and the Navy to validate that the contract (RFP and proposal) requirements are met.

   As with design-bid-build contracts discussed in the last chapter, the process to review design submittals includes the EFD's Design Division, the user and the ROICC Field Office. However, in design-build contracts, the reviews flow through the Field Contract Manager (FCM) who works in coordination with the Project Manager (PM).

   The PM provides a liaison with the user and solicits their review of the design's functional and operational characteristics. Meanwhile, the EFD's technical team reviews the design for compliance with the contract as well as ensuring the design is consistent with standard engineering practices and that it meets applicable code and criteria requirements. The PM consolidates the

review comments from the user and technical team and provides them to the FCM.

The FCM, with support from the local Field Office reviews the documents for contract compliance regarding safety, quality, environmental controls, schedule, local base procedures and the construction practices and techniques to be employed. The FCM combines the field comments with the review comments provided by the PM and submits them to the contractor. If necessary the FCM will conduct a Review Contract with the contractor. Out of scope changes will be handled by contract modifications.

2. *Constructing the Facility* involves the processes used to ensure the facility is built to the accepted design. The FCM must take a proactive approach to construction management to facilitate the safe delivery of quality project with minimal time and cost growth. Areas of concern include safety, Quality Assurance (QA), and submittals.
3. *Administering the Business Aspects of the Contract* is done parallel with and interrelated with construction. The FCM uses set procedures to help ensure the Navy does not cause the contractor delays due to administrative matters. Partnering and regular progress meetings will help to keep the lines of communication open between the Navy and the contractor and will assist in managing the schedule, invoices and

payments, Requests for Information (RFIs), and contract modifications.

4.4 Differences in Design-Build

Now that both the design-bid-build and design-build systems have been explained in detail, this section of the thesis will highlight the procedural differences between the two. Following the procedural differences, the survey of NAVFAC employees will be discussed.

As mentioned before, the first phase of a project, the Feasibility Stage, does not change based on the project delivery system used. Much of the stage will be completed prior to the delivery method is determined. Similarly, the functions once the contract or contracts are awarded are basically the same whether for design management or construction.

During the planning and procurement steps, however, there are notable differences in the procedure. The major change in the procurement of a design-build contract is that it combines two solicitations (the A/E firm and the constructor) into a single contract action. Table 4.1 summarizes the steps taken to procure the different contracts.

Table 4.1 Procurement Processes for Design-Bid-Build and Design-Build

Design-Bid-Build	Design-Build
Prepare Statement of Work (A/E)	Phase I – Request Statements of Qualifications (Design-Builders)
Receive and Evaluate A/E Qualifications	Evaluate technical qualifications and approach
Negotiate w/most qualified A/E	Select most highly qualified offerors
Award Design Contract	Prepare RFP
Prepare Request for Proposal (RFP)	Solicit and Receive Phase II Proposals
Receive Proposals	Technical Evaluation
Technical Evaluation and Ranking	Price Evaluation
Source Selection Board Evaluation	Source Selection Board Evaluation
Discussions with proposers (if nec)	Discussions with proposers (if nec)
Selection of contractor by Source Selection Authority	Selection of contractor by Source Selection Authority
Award Construction Contract	Award Design-Build Contract

4.5 Survey Results

As part of the research for this thesis, a survey was sent to military and civilian employees of the Naval Facilities Engineering Command to measure their perceptions of two delivery systems: design-bid-build and design-build. Military names were chosen from NAVFAC's P-1, a directory of all officers in the Civil Engineer Corps (CEC) by their location, or duty station (NAVFAC, 1999). Members were chosen based on their assignment to NAVFAC Headquarters, an Engineering Field Division or Activity, or a Field Office. Additional surveys were sent to civilian personnel at EFDs, EFAs, or Field Offices who hold positions as

contract specialists, or in the design and planning divisions. This target group was chosen due to the need for responses from individuals with experience on both types of projects.

A total of 126 surveys were sent via e-mail. Fifteen of these were undeliverable addresses leaving a total of 111 surveys received by the target group. There were a total of 27 responses, a return rate of 21.4 percent. Not everyone responded to all categories listed due to lack of experience in an area. For instance, a Field Construction Manager may not have experience in one or both types of project delivery systems during the planning stages. Additionally, some individuals in the targeted group responded indicating that they had no experience with design-build and could not give valid answers to the survey. These individuals are not included in the twenty seven responses. While the sample is small and may not be statistically valid, it does provide good input into the understanding of the differences faced by owner organizations when shifting projects from design-bid-build to design-build delivery methods.

The survey was developed based upon the two processes discussed in Chapter 3 and Chapter 4. At the end of the third chapter a list of functions performed by the Navy during a construction project was shown in Figure 3.4. The survey was based on this list of functions and asked the respondents to gage the difference in level of effort required by the owner for design-bid-build projects versus design-build projects. The list of functions follows:

1. Conduct Site Studies and Engineering Service.
2. Develop the Project Program.
3. Develop Source Selection Plan.
4. Request Statement of Qualifications (A/E).
5. Prepare Request for Proposal (RFP).
6. Solicit, Receive and Evaluate Proposals.
7. Technical Design Review.
8. Requirements Review.
9. Constructability Review.
10. Coordination with Interior Design and Outfitting.
11. Design Acceptance.
12. Pre-Construction Conference.
13. Quality Assurance (QA) – Three Phases of Control.
14. Submittal Management.
15. Requests for Information (RFIs).
16. Change Order Management.
17. Safety Management.
18. Schedule Management.
19. Invoices/Payments.
20. Claim Management.

In addition to the level of effort ratings, respondents were asked to identify the person or position in the owner's organization that is primarily responsible for each of the listed functions. Columns were provided for both design-bid-build and design-build. A copy of the survey directions, a blank survey, and additional comments received from respondents are included in the appendix. The tabulated results are shown in Table 4.2.

Table 4.2 Results of Survey

			Design-Bid-Build			Design-Build		
		# of Resp.	Much Hgher	Slightly Higer	No Difference	Slightly Higher	Much Hgher	AVG
PHASE	ACTIVITY		1	2	3	4	5	
Planning	Conduct Site Studies & Engineering Service	26	0	5	20	1	0	2.85
	Develop the Project Program	26	0	4	16	6	0	3.08
Procurement	Develop Source Selection Plan	27	0	0	10	9	8	3.93
	Request Statement of Qualifications (A/E)	27	2	5	9	11	0	3.07
	Prepare Request for Proposal	27	5	0	7	3	12	3.63
	Solicit, Receive and Evaluate Proposals	26	0	0	7	10	9	4.08
Design	Technical Review	26	2	5	12	5	2	3.00
	Requirements Review	26	0	3	11	9	3	3.46
	Constructability Review	27	0	9	8	9	1	3.07
	Coordination w/Int design & outfitting	26	2	2	18	4	0	2.92
	Design Acceptance	26	4	7	12	1	2	2.62
Construction	Pre-Construction Conference	27	0	2	18	5	2	3.26
	Quality Assurance	27	0	12	15	0	0	2.56
	Submittal Management	27	3	11	13	0	0	2.37
	RFIs	27	10	10	2	5	0	2.07
	Change Orders	27	6	13	5	3	0	2.19
	Safety Management	27	0	2	25	0	0	2.93
	Schedule Management	27	0	10	12	5	0	2.81
	Invoices/Payments	27	0	2	25	0	0	2.93
	Claim Management	25	2	12	9	2	0	2.44

In general, NAVFAC employees who responded to the survey feel there is a higher level of effort during the procurement steps for design-build than with

design-bid-build. A lower level of effort for the Construction Phase functions counters the increased efforts required in procurement. The Planning Phase showed no significant difference between the two delivery methods while functions in the Design Phase showed increased level of effort either way depending on the specific step.

The lack of significant differences in the Planning Phase can be is supported by the processes described earlier in Chapter Three and Chapter Four. It was shown that the early project planning or feasibility process is separate from and independent of the acquisition planning that is used to decide how a particular project will be executed.

Potential reasons cited for increased level of effort in design-build contracts during the procurement steps included a higher need to capture all of the users' requirements up front instead of adding or changing items during the early design reviews. In design-build, such changes not only impact the design but also could require a modification to the construction contract because the contract price has been set. In design-bid-build contracts, designers and users of a facility could catch additional items as they went through the design with no change to the construction price. The Request Statement of Qualifications showed no significant change between the two delivery methods (3.07) while the other three functions in this phase which dealt with developing the procurement plan, preparing the RFP, and evaluating and selecting the contractor(s) all had

significantly more responses that indicated a greater level of effort for design-build.

During the Design Phase, which includes all of the design review and acceptance steps, the majority of efforts showed no significant difference in level of effort. The engineering and architectural technical review was even in its distribution with a 3.00 average and the majority of responses indicated no difference. The Field Office's constructability reviews also showed a similar distribution as did the coordination with the interior design and outfitting steps.

One of the significant areas of difference for the Design Phase were in the requirements review which had twelve responses indicating a greater level of effort for design-build contracts compared to eleven showing no difference and three showing slightly less effort for design-build. This level of effort matches the same increase during the preparation of the RFP where some respondents stressed the need to clearly identify and communicate all of the requirements up front.

The second difference during design was for the acceptance of the design which had eleven responses indicating less level of effort for design build with twelve showing no difference and only three indicating a higher level of effort for design-build than for design-bid-build. These results appear to follow the shift in design responsibility away from the Navy, the owner, to the design-build contractor.

All but one of the functions during the Construction Phase showed a net result of less effort required for design-build contracts. Only the Pre-Construction Conference (Pre-Con) showed an increased level of effort for design-build. For design-build projects, multiple meetings will often take place during the execution phase (design and construction) prior to the start of construction. In addition to Pre-Con, mutual understanding meetings are conducted to ensure the Navy and its contractors share a common understanding of the requirements included in the RFP.

All other functions during construction showed greater level of effort required during traditional design-bid-build projects or no significant difference. Safety management and the processing of invoices for payment to the contractor showed very little difference with 25 of the 27 responses received indicated no difference between delivery methods for these functions. There was also only a slight trend in the responses for schedule management showing less effort required for design-build.

The areas with the greatest change in the owner's level of effort were Requests for Information, Change Orders, and Submittal Management with average scores of 2.07, 2.19 and 2.37 respectively. The first two of these areas traditionally grew with the amount of friction between the owner's designers and his builders. As conflicts in interpretation and over errors and omissions grew, so would an owner's costs and management efforts. Design-build contracts minimize

these areas by placing the designers and builders on the same team from the early design through the end of the construction.

As questions of scope and changes diminish during construction so do the number and difficulty of claims. Only two respondents indicated a slightly higher level of effort for claim management on design-build contracts. Fourteen indicated lesser level of effort (twelve slightly less and two much lower) for claims on design-build while nine indicated no difference. Quality Assurance also showed slightly less level of effort required for design-build.

One respondent noted that while the individual functions might require less effort for design-build, the compression of the project execution curve as shown in Figure 4.1 results in a faster paced management environment requiring faster turnaround of RFI's, changes, and submittals. This increased pace, according to comments received with the survey, may result in a net increase in the owner's level of effort.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Owners seeking to benefit from the design-build delivery system must be prepared for changes required in the management of design-build contracts. Using the Navy as a model owner organization, the following conclusions can be drawn from this research:

1. The processes used to procure design-build contracts differ from traditional methods. Use of a source selection plan, as required by the FAR for Navy projects can help ensure either delivery system is used effectively and in accordance with statutory regulations for public owners.

2. Functions during the design and possibly during procurement will shift from corporate or regional levels down to the field offices.

3. The level of effort required to manage design-build contracts can be higher during planning and procurement stages. Extra care is required

to ensure the facility users' requirements are wholly explored and well defined.

4. The level of effort required for construction management is lower in design-build contracts. However, this may be offset by the compressed execution schedule and the shift of additional functions to the field office.

5.2 Recommendations

While much research has been done to measure the benefits of various delivery systems, more research is required to help remove barriers of knowledge and capabilities that keep some owners from exploring the delivery methods that might best fit their project needs. The following areas are recommended for further development:

1. More detailed research into the owner's level of effort during the procurement and execution stages should seek to measure actual resources used to quantify the level of effort rather than rely on the perceptions of those involved. Such studies will either support the conclusions from this thesis or will highlight areas where expectations are not matching actual performance. It also may be able to highlight

new skills and traits needed within NAVFAC and other owners' organizations to manage in the changed environment of design-build.

2. Similar case studies and surveys of private owner organizations will be beneficial to help educate owner organizations as to the best practices being used by organizations with design-build experience.

3. This thesis and studies of other owner organizations can be used as a basis for determining effective ways to plan for and execute design-build contracts. The end result could be an educational guide for less experienced owners and a list of "best practices" used in both public and private sectors.

4. Once a "best practices" list is developed, it can be used to identify legislative barriers at the state and federal levels that inhibit the most effective use of design-build for public agencies. Results from studies that demonstrate the effectiveness of design-build as a delivery system can then be used along with the owners' "best practices" to educate members of various legislatures and remove barriers to design-build for public agencies.

APPENDIX

Information regarding the survey and the results received is contained in this appendix as follows:

1. Directions for Survey,

2. Blank Survey Form, and

3. Additional Comments Received.

Owner's Level of Effort: Design-build versus Design-bid-build

Part One: Personal Information

Please provide information about the position you held during your experience with design-build and design-bid-build projects as it applies to this survey. This may or may not be your current position.

Part Two: Level of Effort Comparison

For each activity listed, please indicate:

1) *The level and position PRIMARILY responsible for that function (ex: Field Office/AROICC) in Design-Bid-Build Contracts.*

2) *The difference in level of effort required between Design-Bid-Build and Design-Build contracts. A score of 1 indicates much higher level of effort for design-bid-build, while a 5 indicates a much higher level of effort required for design-build. Remember that these questions should be answered from the Navy's perspective, not the Contractor's.*

3) *The level and position PRIMARILY responsible for that function in Design-Build Contracts.*

4) *Any major functions you feel have been omitted can be added to the bottom of the form along with your input following steps 1-3 above.*

The following definitions are provided for use with the attached survey.

Site Studies & Engineering Services: Contracting for Topographical surveys, site utility surveys, wetlands delineation, geotechnical investigations, hazardous material assessment, and review of NEPA to identify additional studies.

Develop the Project Program: An analysis of the project that describes the operational, functional, and space planning aspects from an architectural and engineering standpoint.

Develop Source Selection Plan: The government's plan that describes the participants in the selection process and their duties, the evaluation criteria, the method of evaluation, and the milestones from solicitation to award.

Request Statement of Qualifications: The process used to determine the most highly qualified firms who will be asked to submit a proposal in response to a RFP. For design-bi-build contracts this should be considered as it pertains to selecting an A/E firm to do the design. For Design-build it applies to the DB contractors.

Prepare Request for Proposal: The RFP is a document that includes contract clauses, contract administration procedures, performance and prescriptive specifications, project program, site information, and other attachments.

Solicit, Receive, and Evaluate Proposals: The process to determine the proposal providing the best value to the government and to award the contract. For design-bid-build, this includes both the A/E selection and negotiation process as well as a source selection process for the construction.

Technical Review: This is the design review normally done at the 35%, 100%, and final submissions by design engineers and architects.

Requirements Review: This is a review to ensure the user's requirements as specified have been included in the design package.

Constructability Review: This review is normally completed by the Field Office technical experts.

Coordination w/Interior Design & Outfitters: This requires the coordination of design aspects with the follow-on contractors and agencies for furniture, equipment, telephones, etc.

Design Acceptance: The process of the Navy's acceptance of the design as developed by an A/E form or design-build team.

PART ONE									
	Organization (EFD, EFA, ROICC):								
	Position (AROICC, Design Eng, Architect, CO):								
	Employment (Military or Civilian):								
PART TWO									
		Design-Bid-Build					Design-Build		
		Owner's Level of Effort is:	N/A	Much Hgher	Slightly Higer	No Differen ce	Slightly Higher	Much Hgher	
PHASE	ACTIVITY	Performed By (DBB):	0	1	2	3	4	5	Performed By: (DB)
Planning	Conduct Site Studies & Engineering Service								
	Develop the Project Program								
Procurement	Develop Source Selection Plan								
	Request Statement of Qualifications (A/E)								
	Prepare Request for Proposal								
	Solicit, Receive and Evaluate Proposals								
Design	Technical Review								
	Requirements Review								
	Constructability Review								
	Coordination w/Interior design & outfitting								
	Design Acceptance								
Construction	Pre-Construction Conference								
	QA (3 Phases of Control)								
	Submittal Management								
	RFIs								
	Change Order Management								
	Safety Management								
	Schedule Management								
	Invoices/Payments								
	Claim Management								
Additional Functions:									

Additional Comments Received

In addition to the survey responses several of the respondents sent additional comments. Some of their remarks are included below.

(1) In general, the same things must happen in both processes. The biggest efficiency is gained by having one contractor responsible for both the design and the construction which eliminates the delays and claims between the A/E and construction contractor. From that standpoint, the government's work is easier and faster. However, we've taken a process that used to take five years and compressed it to three years. This makes the government's job harder because we are solving problems in the field that were historically solved during the design phase with the A/E. The government's turn-around times are now much quicker as a result.

In summary, I believe the government's level of effort on each project has been reduced to some extent, but has been compressed into a shorter period of time. This has the net result of increasing our workload.

(2) Government review of A/E plans and specs [in design-bid-build] is critical prior to award. RFP management is critical in a DB project. Contractor is fully responsible for design. DB is more work up front and could (or should) be less work to complete if the RFP is all-inclusive.

(3) Planning – There is no difference between DB & DBB in planning because the final decision on which method to use has not been made yet.

Procurement – SWDIV is now using the RFP process to select their contractors. Thus we do not use the old DBB. For this survey, I will to refer to Design - RFP- Build process as DBB. The preparation of the RFP requirements for a DB project must be more complete because the Navy has less flexibility to get free design changes, due to the contract construction price having already been fixed. DBB projects need more review of the AE, because we have more design liability on this type of project.

Design –Technical reviews need to be more complete on DBB, because the Navy is usually liable for ambiguities in the contract documents.

Construction - DB contracts eliminate the RFIs, contract changes orders and claims that arise due to different interpretations of the plans and specifications by the contractor versus the Navy. This saves a lot of ROICC construction management time.

(4) I firmly believe that D-B will produce better finished products with less post award problems than traditional D-b-b. Also the Post-Award side of the house really needs to pay attention to the pre-award side. A little preventive intervention will save dollars and headaches later.

(5) The user usually gets a building to occupy a lot earlier on a design-build contract. More ROICC effort is shifted from RFIs to doing design reviews and RFP criteria checks. Need to consider design as part of modifications.

(6) Additional Functions to be considered (part of the Construction Phase):

Mutual Understanding Meeting
Partnering Meetings

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